

EXPERIMENT-7

Aim: Installation and working with Telnet (Terminal Network).

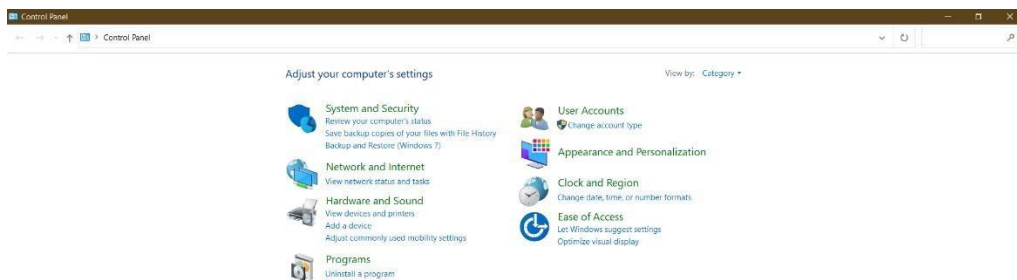
Telnet:

- It is a popular client-server program used to provide a general client-server environment where the user can access any application program of remote computer.
- It stands for Terminal Network.
- It provides connection to remote computer in a way that local terminal appears to be at remote side.

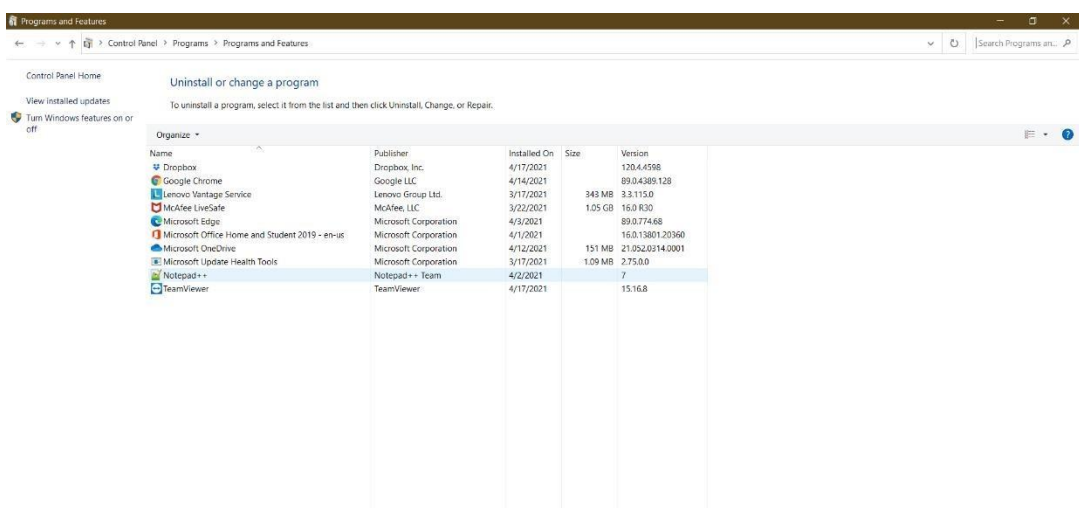
Installation of Telnet on Windows:

Unlike Linux Telnet is not preinstalled in on Windows, it can be installed by following steps:

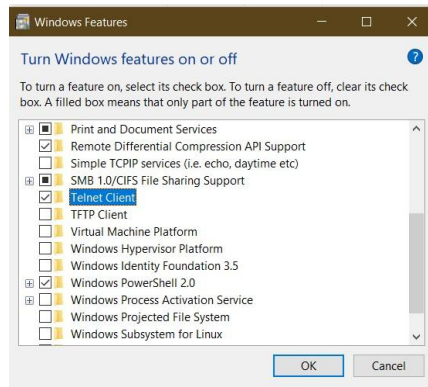
- 1) Click on **Start**.
- 2) Select **Control Panel**.



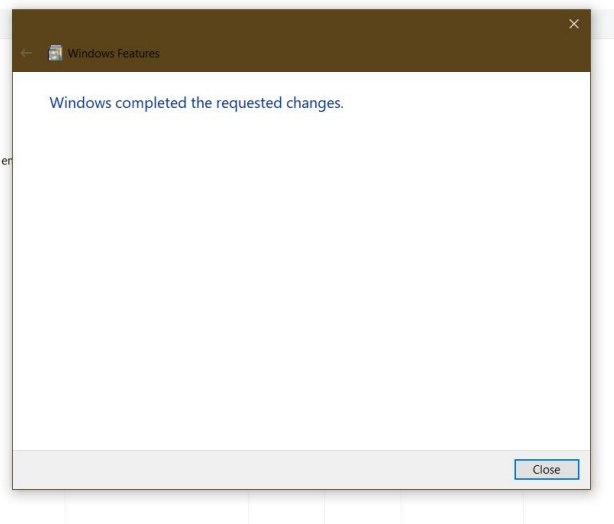
- 3) Choose **Program and Features**.



- 4) Click **Turn Windows features on or off**.
- 5) Select the **Telnet Client** option.



- 6) Click OK.
- 7) A dialogue box appears to configure the installation. The Telnet commands are then available.



EXPERIMENT-8

Aim: Installation and working with FTP (File Transfer Protocol).

FTP:

File Transfer protocol server can be set up on Windows to upload and download files from virtually anywhere to the computer without the limitations of the cloud storage. It creates a private cloud without any file or size restrictions and can be used for multiple accounts. Thus, it proves to be very useful personally and professionally.

Installation of FTP server components:

1. The required components of FTP can be added manually.
2. Open *Control Panel*.
3. Click on *Programs*.
4. Under *Programs and features* click the *Turn Windows features on or off*.
5. When the dialog box opens, expand the *Internet Information Services* feature and expand *FTP server* option.
6. Check the *FTP Extensibility* and *FTP Service* option.
7. Check the *Web Management Tools* option with the default selections, but making sure that the *IIS Management Console* option is checked.
8. Click the OK button.
9. Click the Close button.

Configure FTP server site on Windows 10

After installing the required components, configure an FTP server on the computer, which involves creating a new FTP site, setting up firewall rules, and allowing external connections.

Setting up an FTP site

- 1) Open *Control Panel*.
- 2) Click on *System and Security*.
- 3) Click on *Administrative Tools*.
- 4) Double-click the *Internet Information Services (IIS) Manager* shortcut.
- 5) On the *Connections* pane, right-click *Sites*, and select the *Add FTP Site* option.
- 6) In the FTP site name, type a short name for your server.
- 7) In the *Content Directory* section, under *Physical path* click the button on the right to locate the folder you want to use to store your FTP files.
- 8) Click the Next button.
- 9) Use the default *Binding settings* selections.
- 10) Check the *Start FTP site automatically* option.
- 11) In the "SSL" section, check the *No SSL* option
- 12) Click the Next button.
- 13) In the *Authentication* section, check the *Basic* option.
- 14) In the *Authorization* section, use the drop-down menu, and select *Specified users* option.

- 15) Type the email address of your Windows 10 account or local account name to allow yourself access to the FTP server.
- 16) Check the *Read and Write* options.
- 17) Click on the *Finish* button.

FTP is now operational on the computer.

Configuring Firewall Rules:

The services should be manually allowed as the built-in firewall on Windows-10 will block the FTP server.

- 1) Open *Windows Defender Security Center*.
- 2) Click on *Firewall & network protection*.
- 3) Click the *Allow an app through firewall* option.
- 4) Click the *Change settings* button.
- 5) Check the *FTP Server* option, as well as the options to *allow Private and Public access*.

Allowing External Connections:

For reaching external servers, TCP/IP port number 21 has to set up.

- 1) Open *Settings*.
- 2) Click on *Network & Internet*.
- 3) Click on *Status*.
- 4) Click the *Change connections properties* option.
- 5) Make a note of the IPv4 DNS server address, which is the address of your router. Usually, it's private address in the 192.168.x.x range. For instance, 192.168.1.1 or 192.168.2.1.
- 6) Open your default web browser.
- 7) On the address bar enter the router's IP address and press Enter.
- 8) Sign-in with your router credentials.
- 9) Open the *Port Forwarding* page.
- 10) Add a new rule to forward incoming connections to the FTP server from the internet by including this information:
Service name: Type a descriptive name for the port forwarding rule.
Port range: 21.
Local IP: This is the FTP server IP address that the router will forward incoming connections. Local port:21.
Protocol: TCP
- 11) Click the add button.
- 12) Click the Apply button to save the changes.

After completing the steps, any incoming connection on port 21 will be forwarded to the FTP server to establish a networking session

Setting up static IP address:

- 1) Open *Control Panel*.
- 2) Click on *Network and Internet*.

- 3) Click on *Network and Sharing Center*.
- 4) In the left pane, click the *Change adapter settings* option.
- 5) Right-click the network adapter, and select the *Properties* option.
- 6) Select the *Internet Protocol Version 4 (TCP/IPv4)* option.
- 7) Click the *Properties* button.
- 8) Select the *Use the following IP address* option.
- 9) Specify the IP settings:
IP address: Specify a static network address for the computer.
Subnet mask: In a home network, the address usually is 255.255.255.0.
Default gateway: This is usually the IP address of the router.
Preferred DNS server: Typically, this is also the IP address of your router.
- 10) Click the OK button.
- 11) Click the Close button.

Set up multiple FTP accounts on Windows 10:

If you want to allow multiple people to download and upload files to the FTP server simultaneously, you need to set up multiple accounts with specific permissions

Creating new user accounts:

- 1) Open *Settings*.
- 2) Click on *Accounts*.
- 3) Click on *Family & other people*.
- 4) Click the *Add someone else to this PC* button.
- 5) Type the Microsoft account address for the user you want to allow access to the FTP server.

Configuring user accounts to FTP server:

- 1) Open *Control Panel*.
- 2) Click on *System and Security*.
- 3) Click on *Administrative Tools*.
- 4) Double-click the *Internet Information Services (IIS) Manager* shortcut.
- 5) On the left pane, expand *Sites*, and select the site you created earlier.
- 6) Double-click the *FTP Authorization Rules* option.
- 7) On the right pane, click the *Add Allow Rule* option.
- 8) Select one of these two options:
All Users: Allows every user configured on your Windows 10 device to access the FTP server.
Specified users: You can use this option to specify all the users you want to access the FTP server. (separate each user using a comma.)
- 9) Check the *Read and Write* options.
- 10) Click the OK button.

Connect to an FTP server remotely on Windows 10

Viewing and downloading files:

- 1) Open a web browser.
- 2) In the address bar, type the server IP address using ftp://, and press Enter. For example,ftp://192.168.1.100.
- 3) Type your account credentials.
- 4) Click the *Log in* button.

After these steps, you will be able to navigate and download files and folders from the server.

Viewing, downloading and uploading files:

- 1) Open File Explorer.
- 2) In the address bar, type the server address using ftp://, and press Enter. For example,ftp://192.168.1.100.
- 3) Type your account credentials.
- 4) Check the *Save password* option.
- 5) Click the *Log on* button.

After completing these steps, you can browse files and folders, and download and upload files as if they are locally available on your device.

Configuring multi-users:

There are multiple procedures for doing so to allow others to access the FTP server:

Create multiple FTP accounts:

- 1) Open settings app. (Windows key + I.) 2) Click *accounts*.
- 3) Navigate to the left-side pane, where you'll see an option called *family & other users*. Click the link.
- 4) On the right-hand side, look for the option *Add someone else to this PC*.
- 5) In the next screen, you'll be prompted to enter that person's email ID or phone number. Look for a link called *I don't have this person's sign in information* at the bottom left. Click the link.
- 6) In the next screen, you'll be asked to enter the personal details of the new user. If you know the other person's Microsoft account details, you can enter. Otherwise, look for a link called *add a user without a Microsoft account* on the bottom left.
- 7) In the next screen, enter the details of the user. Choose a strong password for your own security as this server can be accessed from the Internet.

Add a new user to the FTP folder

- 1) Navigate to the FTP folder, right-click on it and select *properties*.
- 2) Click the *security* tab and navigate to *edit* button.
- 3) Look for *Add* button in the next screen and click on it. This will open the *select users or groups* dialog box. In this screen, enter the name of the user you want to add in the text area. Click on *check names* button to make sure that you have entered the right name.

- 4) Click OK
- 5) Select the newly added user account and set the permissions for this user. Once done, click apply and OK.

Configure the user to access the FTP folder

- 1) Go to *control panel* and open *administrative tools*.
- 2) Double-click *Internet information services (IIS) manager*.
- 3) Expand the left-hand pane and navigate to sites. Click on sites and you'll see your FTP server. Select this server.
- 4) On the right-hand pane, you'll see many options. Look for *authorization rules*. Rightclick on it and select *add allow rules* from the context menu.
- 5) In the next screen, choose *selected users* option and enter the Windows 10 account you created earlier. Set the permission you'd like this user to have. Click OK.

Windows has an in-built feature for setting up the FTP server, and so it can be set up with great ease. FTP provides lot of flexibility and convenience and even allow multiple users addition so that sending and receiving files could be made easier.

EXPERIMENT-9

Aim: Implementation of various MAC protocols.

Algorithm:

- 1) Create a Simulator object.
- 2) Define different colours for different data flows.
- 3) Open a nam trace file and define procedure, after which close the trace file and execute nam on trace file.
- 4) Create six nodes and form a network, 0,1,2,3,4,5.
- 5) Create duplex links between the nodes and add orientation to the nodes for topology.
- 6) Setup TCP connection between n(0) and n(4).
- 7) Apply FTP traffic over TCP.
- 8) Setup UDP Connections between n(1) and n(5).
- 9) Apply CBR traffic over UDP.
- 10) Apply CSMA/CA and CSMA/CD mechanisms and study their performance 11)
Schedule the events and run the program.

Program Code:

```
#csma.tcl
set ns [new Simulator]
#Define different colors for data flows (for nam)
$ns color 1 Blue
$ns color 2 red #Open the
Trace files set file1 [open
out.tr w] set winfile [open
Winfile w] $ns trace-all
$file1 #Open the NAM
trace file set file2 [open
out.nam w] $ns namtrace-
all $file2 #Define a 'finish'
procedure proc finish {} {
global ns file1 file2 $ns
flush-trace close $file1
close $file2
exec nam out.nam &
exit 0
}
#create six nodes
set n0 [$ns node]
set n1 [$ns node]
set n2 [$ns node]
set n3 [$ns node]
set n4 [$ns node]
```



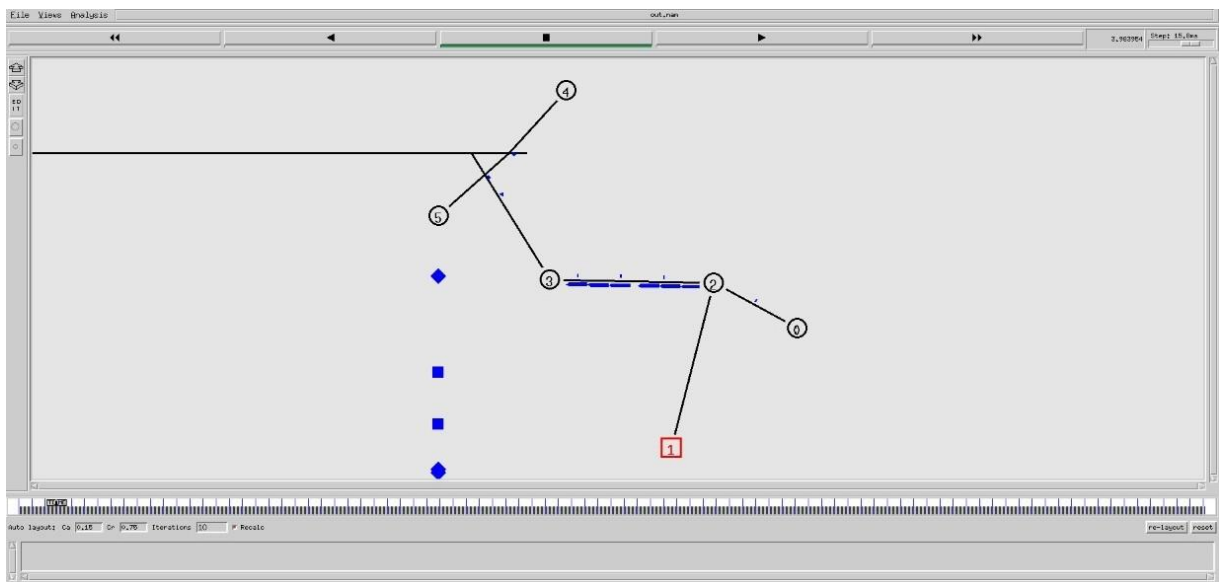
```

set n5 [$ns node]
$n1 color Red
$n1 shape box
#create link between nodes
$ns duplex-link $n0 $n2 2Mb 10ms DropTail
$ns duplex-link $n1 $n2 2Mb 10ms DropTail
$ns simplex-link $n2 $n3 0.3Mb 100ms DropTail $ns
simplex-link $n3 $n2 0.3Mb 100ms DropTail
set lan [$ns newLan "$n3 $n4 $n5" 0.5Mb 40ms LL Queue/Droptail MAC/Csma/Ca Channel]
#setup a TCP connection set tcp
[new Agent/TCP/Newreno] $ns
attach-agent $n0 $tcp
set sink [new Agent/TCPSink/DelAck]
$ns attach-agent $n4 $sink
$ns connect $tcp $sink
$tcp set fid_ 1
$tcp set window_ 8000
$tcp set packetSize_ 552 #setup
FTP over TCP connection set ftp
[new Application/FTP]
$ftp attach-agent $tcp
$ftp set type_ FTP #setup
a UDP connection set udp
[new Agent/UDP] $ns
attach-agent $n1 $udp set
null [new Agent/Null] $ns
attach-agent $n5 $null
$ns connect $udp $null
$udp set fid_ 2
#setup a cbr over udp connexion set
cbr [new Application/Traffic/CBR]
$cbr attach-agent $udp
$cbr set type_ CBR
$cbr set packet_size_ 1000
$cbr set rate_ 0.01mb
$cbr set random_ false
$ns at 0.1 "$cbr start"
$ns at 1.0 "$ftp start"
$ns at 123.0 "$ftp stop"
$ns at 124.5 "$cbr stop"
#next procedure gets two arguments: the name of tcp source node will br called here tcp
#and the name of output file
proc plotWindow {tcpSource file} {

```

```
global ns set time 0.1 set now
[$ns now] set cwnd [$tcpSource
set cwnd_] set wnd [$tcpSource
set window_] puts $file "$now
$scwnd"
$ns at [expr $now+$time] "plotWindow $tcpSource $file"}
$ns at 0.1 "plotWindow $tcp $winfile"
$ns at 5 "$ns trace-annotate \"packet drop\""
#PPP
$ns at 125.0 "finish"
$ns run
```

Output:



EXPERIMENT-10

Aim: Performance Evaluation of routing Protocol.

Routing Protocol:

This protocol is a set of rules used by the routers to communicate between the source and destination. Each protocol has its own algorithm to choose path.

There are two kinds of routing:

- 1) *Unicast Routing*: It is a type of information transfer and used when there is a participation of single sender and a single recipient.
- 2) *Multicast Routing*: It used in case of multiple senders and recipients.

Performance Analysis of routing Protocol:

The analysis of routing Protocol can be assessed by factors such as:

- 1) *Packet delivery Ratio*: It is measured as the ratio of number of packets delivered in total to the number of packets sent from the source node to destination node.
- 2) *Energy Consumptions*: Energy consumption is measured as the total energy used to perform the complete process.
- 3) *Throughput*: The number of packets transferred per unit time.
- 4) *Average Delay*: It is the delay per packet transfer from source node to the destination node.

All of the above factors and some others affect the performance of routing protocol and can be used to assess its performance.

Program Code:

The following program shows how an XGraph can be used to plot the bandwidth of two nodes connected through the duplex wired link (An XGraph program draws a graph on an xdisplay given data read from either data file or standard input):

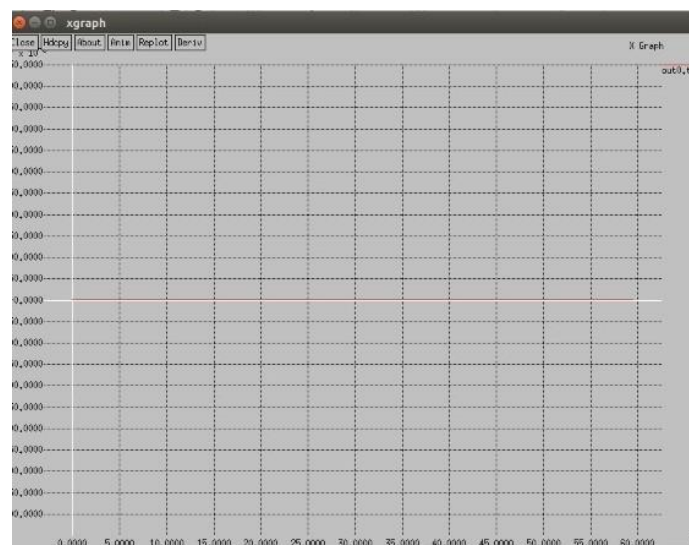
```
#Create a simulator object
set ns [new Simulator]
#Open the output trace
file set f0 [open out0.tr w]
#Create 2 nodes set n0
[$ns node] set n1 [$ns
node]
#Connect the nodes using duplex link
$ns duplex-link $n0 $n1 1Mb 100ms DropTail
#Define a 'finish' procedure
proc finish {} { global f0
#Close the output files close
$f0
#Call xgraph to display the results
exec xgraph out0.tr -geometry 800x400 & exit
0
```

```

}
#Define a procedure which periodically records the bandwidth received by
the proc record {} { global sink0 f0
#Get an instance of the simulator set
ns [Simulator instance]
#Set the time after which the procedure should be called again
set time 0.5
#How many bytes have been received by the traffic sinks?
set bw0 [$sink0 set bytes_] #Get the current time set now
[$ns now]
#Calculate the bandwidth (in MBit/s) and write it to the files puts
$f0 "$now [expr $bw0/$time*8/1000000]"
#Reset the bytes_ values on the traffic sinks
$sink0 set bytes_ 0
#Re-schedule the procedure
$ns at [expr $now+$time] "record"
}
#Create three traffic sinks and attach them to the node n4
set sink0 [new Agent/LossMonitor] #Start
logging the received bandwidth
$ns at 0.0 "record"
$ns at 60.0 "finish"
#Run the simulation
$ns run

```

Output:



EXPERIMENT-11

Aim: Implement an Ethernet LAN using n nodes and set multiple traffic nodes and plot congestion window for different source / destination.

Program Code:

```
set ns [new Simulator]
set tf [open lab7.tr w]
$ns trace-all $tf set nf
[open lab7.nam w] $ns
namtrace-all $nf set n0
[$ns node] set n1 [$ns
node] set n2 [$ns node]
set n3 [$ns node]
$ns make-lan "$n0 $n1 $n2 $n3" 10mb 10ms LL Queue/DropTail Mac/802_3
set tcp0 [new Agent/TCP] $ns attach-agent $n0 $tcp0 set ftp0 [new
Application/FTP] $ftp0 attach-agent $tcp0 set sink3 [new Agent/TCPSink]
$ns attach-agent $n3 $sink3
$ns connect $tcp0 $sink3 set
tcp2 [new Agent/TCP] $ns
attach-agent $n2 $tcp2 set ftp2
[new Application/FTP] $ftp2
attach-agent $tcp2 set sink1
[new Agent/TCPSink]
$ns attach-agent $n1 $sink1
$ns connect $tcp2 $sink1
#####To trace the congestion window##### set
file1 [open file1.tr w]
$tcp0 attach $file1
$tcp0 trace cwnd_
$tcp0 set maxcwnd_ 10
set file2 [open file2.tr w]
$tcp2 attach $file2
$tcp2 trace cwnd_ proc
finish { } { global nf
tf ns $ns flush-trace
exec nam lab7.nam &
close $nf
close $tf

exit 0
}
$ns at 0.1 "$ftp0 start"
$ns at 1.5 "$ftp0 stop"
```

\$ns at 2 "\$ftp0 start"
\$ns at 3 "\$ftp0 stop"
\$ns at 0.2 "\$ftp2 start"
\$ns at 2 "\$ftp2 stop"
\$ns at 2.5 "\$ftp2 start"
\$ns at 4 "\$ftp2 stop"
\$ns at 5.0 "finish"
\$ns run **awk**
script:

```
BEGIN {  
} { if($6=="cwnd_") /* don't leave space after writing  
cwnd_ */ printf("%f\t%f\t\n",$1,$7); /* you must put \n in  
printf */  
}  
END {  
}
```

Output:

